

An Ecologically Based Model of Alcohol-Consumption Decision Making: Evidence for the Discriminative and Predictive Role of Contextual Reward and Punishment Information*

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ABSTRACT. Objective: Using insights from Ecological Systems Theory and Reinforcement Sensitivity Theory, the current study assessed the utility of a series of hypothetical role-based alcohol-consumption scenarios that varied in their presentation of rewarding and punishing information. **Method:** The scenarios, along with measures of impulsive sensation seeking and a self-report of weekly alcohol consumption, were administered to a sample of alcohol-dependent and non-alcohol-dependent college-age individuals ($N = 170$). **Results:** The results showed scenario attendance decisions were largely unaffected by alcohol-dependence status and variations in contextual reward and punishment information. In contrast to the attendance findings, the results for the

alcohol-consumption decisions showed alcohol-dependent individuals reported a greater frequency of deciding to drink, as well as indicating greater alcohol consumption in the contexts of complementary rewarding or nonpunishing information. Regression results provided evidence for the criterion-related validity of scenario outcomes in an account of diagnostic alcohol problems. **Conclusions:** The results are discussed in terms of the conceptual and predictive gains associated with an assessment approach to alcohol-consumption decision making that combines situational information organized and balanced through the frameworks of Ecological Systems Theory and Reinforcement Sensitivity Theory. (*J. Stud. Alcohol Drugs* 70: 446-457, 2009)

MUCH OF ALCOHOL-ABUSE RESEARCH has been devoted to the study of individual difference factors—such as personality traits and cognitive abilities—that discriminate alcohol-dependent (AD) individuals from non-AD individuals (e.g., Bogg and Roberts, 2004; Finn et al., 1999). This research has yielded insights into the proclivities and abilities that differentiate AD from non-AD individuals (e.g., tendency to be more impulsive, socially deviant, and display reduced cognitive capacity in the forms of working memory, conditional associative learning, and intelligence quotient [IQ]; see Finn, 2002). In addition, a number of studies indicate impaired decision making, increased discounting of delayed rewards, and poor behavioral inhibition on laboratory tasks are associated with excessive alcohol use in young adulthood, early-onset alcohol dependence, behavioral problems, and impulsive personality traits (Bechara et al., 2001; Bickel and Marsch, 2001; Finn et al., 2002; Mazas et al., 2000).

Despite the empirical and conceptual gains associated with these lines of research, the nature of the tasks used in much of this research makes it difficult to discern the relevance of subsequently observed impaired decision making for actual decisions to drink. These research approaches

highlight the need for investigations of the situational factors that might differentially account for how decisions about alcohol consumption are made. That is, how do AD and non-AD individuals attend to varying situational contingencies when making alcohol-consumption decisions? Specifically, in the current study, the goal is to provide an initial account of how college-age AD and non-AD individuals generate responses to face valid situations that, as in everyday life, can vary in their presentation of rewarding and punishing information and also require a series of decisions that might ultimately lead to excessive alcohol consumption.

To date, there has not been a comprehensive model or theory regarding the ecology of alcohol consumption or the ecology of the consumption of licit and illicit substances in general. This is due, in large part, to the consensus understanding that patterns of alcohol use and substance-use behaviors (and other externalizing problems), like those of most patterns of behavior, are explained by the dynamic interplay of genetic and environmental factors (e.g., Blomeyer et al., 2008; Dick et al., 2001; Kaufman et al., 2007). As suggested above, the lack of an ecological model of alcohol consumption also is the result of research approaches that have relied heavily on factorial designs to parse differences between AD and non-AD individuals on assorted personality, motivation, cognitive, and task performance constructs. Implicit in such designs is an emphasis on individual difference factors—rather than situational factors—as being critical to understanding alcohol use and abuse. Other lines of research have focused more on the relationship between

Received: June 9, 2008. Revision: October 28, 2008.

*This research was supported by National Institute of Alcohol Abuse and Alcoholism grant R01 AA13650 to Peter R. Finn.

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alcohol dependence and enduring environmental factors, such as socioeconomic status, family structure, and marital status (Compton et al., 2007; Harford et al., 2006; Zhou et al., 2006).

Important as these factors are, they leave disconnected part of the interlinked biological-cognitive-situational substrate of experience leading an individual, for example, from a proclivity for sensation seeking and/or reduced working memory ability to making a set of decisions that leads to the consumption of five or more drinks at a friend's party in a few days. An ecological assessment of alcohol-consumption decision making can provide a more complete account of the link between cognitive/personality and situational factors that leads to the experience of alcohol consumption in a specific situation. This form of assessment can account for how situational factors might ameliorate or exacerbate a vulnerability or disposition for poor decision making in regard to excessive alcohol consumption. For example, a simulated alcohol purchase task administered to college students provided support for a behavior-economic approach to studying alcohol consumption based on demand curves and showed that parameters derived from the task differentiated heavy and light drinkers, as well as predicted post-intervention outcomes (MacKillop and Murphy, 2007; Murphy and MacKillop, 2006).

Although the current study does not endeavor to present a comprehensive model or theory of alcohol decision making, it does present an approach to assessing alcohol-consumption decision making that systematically accounts for and varies situational factors that are common and fundamental precursors to alcohol consumption in social settings, while allowing for comparisons between AD and non-AD individuals.

An ecological approach to the study of alcohol-consumption decision making

Two theoretical perspectives guided the conceptual framework for the approach to alcohol-consumption decision making advocated in the current study. The first perspective, drawing from Bronfenbrenner's Ecological Systems Theory (1979; 1988), emphasizes the importance of four contextual systems on human development: micro, meso, exo, and macro. Relevant to the current study is the microsystem, which Bronfenbrenner (1979) defines as "the complex of relations between the developing person and environment in an immediate setting containing that person (e.g., home, school, workplace, etc.)" (p. 514). He further defines a setting as "a place with particular physical features in which the participants engage in particular activities in particular roles (e.g., daughter, parent, teacher, employee, etc.) for particular periods of time. The factors of place, time, physical features, activity, participant, and role constitute the elements of a setting."

Although alcohol-consumption decision making is no doubt influenced by meso-, exo-, and macro-level factors, the

decisions themselves are made in microsystems, restricted to specific settings (i.e., identifiable places, times, with clear participants and roles). As such, we used Bronfenbrenner's definition of a setting to define the characteristics of the hypothetical alcohol-consumption scenarios. The scenarios are designed to convey specific information about the place, time, and participants comprising the setting of possible alcohol consumption. Bronfenbrenner's theoretical definitions of microsystem and setting are particularly useful, because they establish boundaries for what otherwise would be an unwieldy process of selecting important features from a litany of contexts at varying levels of contextual proximity. Specifically, the information presented in all of the scenarios is uniform in regard to deciding (1) whether to attend social gatherings in the company of known others and (2) whether to consume alcohol at such gatherings, where it is known that alcohol will be available. Also in keeping with the definition of setting outlined in Ecological Systems Theory, the scenarios are contextualized to dominant life roles, such that a self-identified college student would respond to scenarios where the context appeals to the immediate experiences of that role (e.g., studying, test-taking, grades).

The second theoretical perspective informing the present study's approach to the assessment of alcohol-consumption decision making is Reinforcement Sensitivity Theory (Gray, 1970; Pickering and Gray, 1999). Reinforcement Sensitivity Theory outlines two competing systems that account for individual differences in sensitivity and reactivity to input stimuli. At a basic level, the behavioral inhibition system is activated by stimuli signaling punishment or frustrative non-reward, whereas the behavioral activation system is activated by stimuli signaling reward or relief from punishment. The two systems represent variations in anxiety and impulsivity, such that low anxiety-high impulsivity individuals will show greater behavioral activation system activation to stimuli processed as rewarding, and high anxiety-low impulsivity individuals will show greater behavioral inhibition system activation to stimuli processed as punishing. The cluster of traits related to behavioral activation system and behavioral inhibition system activation are described as a dimension of impulsive sensation seeking (Pickering and Gray, 1999). In the present study, the appetitive (and ostensibly rewarding) stimulus of interest is alcohol. However, to better capture individual differences in behavioral inhibition system and behavioral activation system activation (i.e., variability in impulsive sensation seeking), the scenarios are designed to vary in the intensity of rewarding and punishing information related to alcohol and role-related contingencies.

Present study

Ecological Systems Theory and Reinforcement Sensitivity Theory provide a clearly bounded framework for the construction and content formulation of alcohol-consumption

decision-making scenarios. The present study uses this framework to investigate variation in alcohol-consumption decision making in a college-age sample of non-AD and AD participants. A hierarchy of questions within each scenario addresses whether a participant would attend a social gathering where alcohol will be available, whether the participant would consume alcohol, and how much alcohol the participant estimates they would consume. As was mentioned above, and consistent with Reinforcement Sensitivity Theory, each scenario conveys rewarding and punishing contextual information. Specifically, the intensity (i.e., high vs low) of the rewarding and punishing information systematically varies across the scenarios.

Much research has shown that AD individuals tend to score higher on the cluster of traits described by Pickering and Gray (1999) as impulsive sensation seeking (Bogg and Roberts, 2004; Finn, 2002; Finn et al., 2000, 2002). In addition, by definition, AD individuals show greater approach (i.e., behavioral activation system activation) tendencies toward alcohol stimuli. Taking these findings and insights into account, it was expected that, compared with non-AD individuals, AD individuals would be more likely to indicate attendance and alcohol consumption (and more of it) at the hypothetical social gatherings when the scenarios describe additional rewarding and/or low punishment information. That is, AD individuals, already tending to score higher on impulsive sensation seeking and being more reactive to alcohol information, should be more sensitive (i.e., approach oriented) to complementary contextual information that is nominally rewarding or less punitive, and, as a result, endorse more attendance and consumption responses.

An important corollary to the above expectations is the predictive utility of the scenarios in accounting for actual alcohol problems. To address this issue, a secondary set of analyses explores the incremental predictive validity associated with scenario attendance, drink decision, and drink amount outcomes in combination with impulsive sensation seeking in the prediction of diagnostic interview-based alcohol problem counts. It is expected that the unique combination of motivational and situational features embedded in the scenarios will provide a substantial increment in the predictive account of diagnostic alcohol problems beyond that of impulsive sensation seeking and self-reported weekly alcohol consumption.

Method

Participants

Recruitment. Participants were recruited through advertisements placed in local newspapers and around the community. The advertisements and flyers were designed to attract respondents that varied in levels of impulsive and disinhibited traits and levels of alcohol use. More important,

this recruitment strategy was used to ensure that (1) control participants varied to some degree in disinhibited behavioral traits and alcohol use and did not meet diagnostic criteria for alcohol dependence, conduct disorder, other substance dependence, or alcohol or other substance abuse and (2) AD participants varied in severity of alcohol-dependence symptoms. The range of advertisements/flyers targeted “daring, rebellious, defiant individuals,” “carefree, adventurous individuals who have led exciting and impulsive lives,” “impulsive individuals,” “heavy drinkers wanted for psychological research,” persons with a “drinking problem,” persons who “got into a lot of trouble as a child,” persons “interested in psychological research,” “quiet, reflective and introspective persons,” and “social drinkers.” This approach has been very effective in attracting responses from controls that vary in disinhibited traits and from AD, antisocial, and generally disinhibited participants (Bauer and Hesselbrock, 1993; Finn et al., 2002; Widom, 1977).

Telephone screening interview. All persons calling in response to an advertisement were administered a telephone screening interview that began with a brief, general description of the study, followed by a series of questions that included questions assessing the general study exclusion criteria, questions about current and lifetime alcohol and other drug use, and diagnostic questions assessing lifetime symptoms of alcohol and other drug abuse and dependence, symptoms of childhood conduct disorder, and adult antisocial personality. Those meeting the group inclusion criteria (noted below) were provided with additional details of the study and asked whether they were interested in participating. Those interested in participating in the study were scheduled for a diagnostic interview (see *Assessment materials* section). Potential participants were told that they must abstain from using alcohol and other drugs for 12 hours before each session. Only those who met the group inclusion criteria after the diagnostic interview in the assessment session were allowed to continue to participate in the study.

Study exclusion criteria. Participants were excluded from the study for the following reasons: (1) they were not between 18 and 30 years of age, (2) they could not read and/or speak English, (3) they had never consumed alcohol, (4) they had less than a sixth-grade level of education, (5) they reported having suffered from any serious head injuries, and/or (6) they had a history of psychosis. It should be noted that, although lifetime abstainers were excluded from the study, individuals currently abstaining from alcohol (i.e., no alcohol consumed in the 3 months before assessment) were not excluded. In practice, the recruitment protocol generally served to exclude current abstainers. However, 9% of the total sample ($n = 16$) reported no typical amount of alcohol consumption in the 3 months before assessment. Based on independent samples t tests, current abstainers from alcohol showed no significant differences ($p > .05$) from the non-AD group on all of the scenario outcomes, the personal-

ity measures, and the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA; Bucholz et al., 1994) alcohol problem counts. In addition, independent samples *t* tests (with non-AD and AD participants) of the scenario outcomes excluding current abstainers produced identical patterns of significant group differences as when the current abstainers were included in the analyses. Consequently, current abstainers were retained in the sample and used in all analyses.

Group inclusion/exclusion criteria. The inclusion criteria for controls were the following: (1) not meeting any Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994) criteria for a lifetime history of alcohol dependence, childhood conduct disorder, antisocial personality, alcohol abuse, or any other substance abuse or dependence, (2) not using marijuana more than eight times in the last 6 months and not using any other mood-altering drug at all in the last 6 months, (3) having 15 or fewer lifetime uses of marijuana, and (4) having four or fewer lifetime recreational uses of other mood-altering drugs. If participants failed to meet any one of the criteria, they were excluded from further participation. The inclusion criterion for the AD group was meeting DSM-IV criteria for a history of alcohol dependence. Participants were not excluded from the AD group if they had current or past other drug abuse or dependence.

Test session exclusion criteria. At the beginning of the assessment session, participants were asked about their alcohol and drug use in the past 12 hours and were given a breath alcohol test using an AlcoSensor IV (Intoximeter, Inc., St. Louis, MO). Participants were rescheduled if their breath alcohol concentration was greater than .0%; they reported consuming any drug within the past 12 hours; they reported feeling hungover; they appeared impaired, high, or overly sleepy; or they were unable to answer questions.

Sample characteristics. The sample ($N = 170$) was fairly evenly distributed among women (55.8 %) and men and had a mean (SD) age of 21.88 (2.84) years. Most participants were white (75.3%), followed by Asian/Asian American (7.6%), black (5.9%), Hispanic (4.7%), Native American (1.2%), and other (5.3%). A majority of the sample had at least some college education (62.1%), indicating the overrepresentation of college students in the sample. More than half of the sample participants met the diagnostic criteria for alcohol dependence (52.9 %).

Assessment materials

Recent alcohol use. In an interview, for each day of the week, participants were asked whether they typically consumed alcohol on that day, and, if yes, the typical amount they consumed on that day. Alcohol use was quantified as the sum of the typical amount of alcohol consumed for each day of the week (i.e., typical weekly alcohol consumption).

Diagnostic interview. Diagnoses of alcohol dependence, childhood conduct disorder, adult antisocial personality, marijuana abuse or dependence, and drug abuse or dependence were determined using the SSAGA (Bucholz et al., 1994), which uses criteria from the DSM-IV. In addition to alcohol-dependence diagnostic status, alcohol-dependence problem counts were retained as an individual difference variable in subsequent analyses. SSAGA lifetime alcohol problem counts were calculated as a sum of dichotomous responses to DSM-IV alcohol dependence criteria as well as dichotomous responses to additional items assessing the physical (e.g., blackouts), psychological (e.g., depression, anxiety, paranoia), and social (e.g., marital or love relationship problems, encounters with law enforcement) manifestations of alcoholism.

Alcohol-consumption decision scenarios. Participants responded to paper-and-pencil scenarios that described a forthcoming social gathering relevant to a major life role (student, homemaker, nonstudent unemployed, or nonstudent employed) where alcohol would be present. Mood (good vs bad), drink delay (party is now vs party is in 2 days), reward magnitude (high vs low), punishment magnitude (high vs low), and punishment implications (long-term vs short-term, with two gradations of magnitude [high vs low] evenly divided within long-term and short-term) information were mixed and balanced, yielding 32 scenarios. Participants were assigned to scenarios based on self-reported life role (i.e., student, homemaker, nonstudent unemployed, nonstudent employed). The majority of the sample was self-assigned the scenarios for the student role (74.7%), followed by the nonstudent working role (14.7%), nonstudent nonworking role (9.4%), and homemaker role (1.2%). The AD and non-AD groups were quite similar with regard to the distribution of role types (e.g., AD student role, $n = 62$; non-AD student role, $n = 65$).

The instructions asked participants to "read brief scenarios about life as a college student [or other self-assigned role] and answer questions about each scenario. Please read each scenario one at a time and then answer the questions for that scenario before moving on to the next one. Try to respond to each scenario as if it were real, as honestly and as accurately as possible." After reading each scenario, the participants indicated whether they would attend the gathering and drink at the gathering, and, if so, they were asked to estimate the number and type of alcoholic beverages to be consumed (e.g., two cans of beer, one shot of tequila, three glasses of wine).

Preliminary analyses indicated that variations in mood, drink delay, and punishment implications information could not be distinguished from the nominally rewarding (i.e., reward magnitude) and punishing (i.e., punishment magnitude) information in the scenarios. Moreover, internal consistency estimates of the attendance questions for the four combinations of reward and punishment magnitude information were

high (reward high–punishment high [RHPH], $\alpha = .79$; reward high–punishment low [RHPL], $\alpha = .78$; reward low–punishment high [RLPH], $\alpha = .78$; reward low–punishment low [RLPL], $\alpha = .82$). This also suggested that, regardless of the mood, drink delay, and punishment implications information, the eight scenarios comprising each of the four reward–punishment combinations represented reliable scales that measured the intended mixture of reward and punishment information. As a result, all subsequent analyses are reported for these four scenario combinations. Examples of each of the four scenario combinations appear below (annotated to indicate original manipulation of information):

COLLEGE STUDENT ROLE, HIGH-MAGNITUDE PUNISHMENT INFORMATION, HIGH MAGNITUDE REWARD INFORMATION (RHPH): “You are in a very good mood [mood: good]. It’s early in the week, and your friend calls you and tells you that there is a get-together on Thursday [drink delay: 2 days]. You have a test first thing in the morning after the get-together. You will have to wake up around 7:30 AM to start the day [punishment magnitude: high]. You need to get a good grade in your class, which you must attend tomorrow, otherwise you will not get into an academic program you want, or you may not get off academic probation [punishment implications: high no. 1]. The get-together is sure to be fun. It will be a major party event. There will be people there who you really like and other party activities that you really enjoy. There will be lots of alcohol and you do not have to pay anything for your drinks [reward magnitude: high].”

COLLEGE STUDENT ROLE, HIGH-MAGNITUDE PUNISHMENT INFORMATION, LOW-MAGNITUDE REWARD INFORMATION (RLPH): “You are in a very bad mood [mood: bad]. It’s Thursday and a friend calls and tells you that there is a get-together or party going on right now [drink delay: immediate]. You have a test the first thing in the morning after the get-together. You will have to wake up around 7:30 AM to start the day [punishment magnitude: high]. The test is not critical to the grade you will end up getting in the course. You can drop the test from your overall final grade [punishment implications: low no. 1]. There will be a few people there, some of whom you know. There will be enough alcohol, so that you can drink what you’d like, but there’s a possibility it will run out eventually [reward magnitude: low].”

COLLEGE STUDENT ROLE, LOW-MAGNITUDE PUNISHMENT INFORMATION, HIGH-MAGNITUDE REWARD INFORMATION (RHPL): “You are in a very good mood [mood: good]. It’s early in the week, and your friend calls you and tells you that there is a get-together on Thursday [drink delay: 2 days]. You do not really have anything to do during the day after the get-together. You can sleep in and don’t have any major responsibilities early in the day [punishment magnitude: low]. You are doing well in school and are not worried about your grades [punishment implications: low no. 2]. The get-together is sure to be fun. It will be a major party event. There will be people there who you really like and other party activities that you really

enjoy. There will be lots of alcohol and you do not have to pay anything for your drinks [reward magnitude: high].”

COLLEGE STUDENT ROLE, LOW-MAGNITUDE PUNISHMENT INFORMATION, LOW-MAGNITUDE REWARD INFORMATION (RLPL): “You are in a very bad mood [mood: bad]. It’s Thursday and a friend calls and tells you that there is a get-together or party going on right now [drink delay: immediate]. You do not really have anything to do during the day after the get-together. You can sleep in and don’t have any major responsibilities early in the day [punishment magnitude: low]. However, you need to study later in the day for a test early next week. You need to get a good grade in your class, otherwise you might not get into an academic program you want, or you may not get off academic probation [punishment implications: high no. 2]. There will be a few people there, some of whom you know. There will be enough alcohol, so that you can drink what you’d like, but there’s a possibility it will run out eventually [reward magnitude: low].”

Impulsive sensation seeking. Carver and White’s (1994) behavioral inhibition and behavioral activation (behavioral inhibition system/behavioral activation system) scales were used to assess self-reported levels of impulsive sensation seeking. The behavioral inhibition system/behavioral activation system scales are comprised of four subscales. The behavioral inhibition system scale assesses responses to potentially punishing events (e.g., “If I think something unpleasant is going to happen I usually get pretty ‘worked up’”; $\alpha = .77$). The behavioral-activation-system reward-responsiveness scale assesses responses to the occurrence or anticipation of reward (e.g., “When I see an opportunity for something I like, I get excited right away”; $\alpha = .63$). The behavioral activation system drive scale assesses responses to items pertaining to the persistent pursuit of goals (e.g., “I go out of my way to get things I want”; $\alpha = .74$). The behavioral activation system fun-seeking scale assesses levels of desire for new rewards and approaching a potentially rewarding event on the spur of the moment (e.g., “I crave excitement and new sensations”; $\alpha = .79$). All items were assessed using a four-point Likert scale (1 = strongly agree, 4 = strongly disagree). In addition to the behavioral inhibition system/behavioral activation system scales, the impulsivity scale from the Eysenck Impulsivity-Venturesomeness test (Eysenck and Eysenck, 1978; $\alpha = .89$), the boredom susceptibility subscale of the Sensation-Seeking Scales (Zuckerman, 1979; $\alpha = .64$), and the harm avoidance subscale of the Multidimensional Personality Questionnaire (Tellegen, 1982; $\alpha = .85$) were used as complementary measures of approach and inhibition tendencies. High Multidimensional Personality Questionnaire harm avoidance scores reflect cautious and restrained tendencies. High Eysenck Impulsivity-Venturesomeness impulsivity scores reflect low self-control, spontaneity, recklessness, and a lack of planning and foresight. The boredom susceptibility subscale, and not the experience-seeking and thrill-and-adventure-seeking subscales, was used because research

TABLE 1. Diagnostic group differences on alcohol-related outcomes, impulsive sensation-seeking personality traits, and college student status

Variable	Non-AD (<i>n</i> = 80) Mean (SD)	AD (<i>n</i> = 90) Mean (SD)	Cohen's <i>d</i>
SSAGA alcohol problem count	4.85 ^a (7.96)	35.87 ^b (14.2)	2.67
Weekly alcohol consumption	5.58 ^a (5.79)	36.32 ^b (25.74)	1.61
BIS	3.13 ^a (.43)	2.95 ^b (.55)	0.36
BAS reward responsiveness	3.49 (.36)	3.48 (.37)	0.03
BAS drive	2.69 ^a (.44)	2.97 ^b (.64)	0.70
BAS fun seeking	2.77 ^a (.58)	3.32 ^b (.50)	1.03
MPQ-harm avoidance	17.20 ^a (5.90)	13.99 ^b (5.15)	0.59
EIV-impulsivity	6.34 ^a (5.01)	11.29 ^b (5.18)	0.98
SSS-boredom susceptibility	2.48 ^a (2.94)	4.12 ^b (2.11)	0.65
Percent and frequency (<i>n</i>) of college students	81.2 % (65)	68.9 % (62)	–

Notes: SSAGA = Semi-Structured Assessment for the Genetics of Alcoholism; BIS = Behavioral Inhibition Scale; BAS = Behavioral Activation Scale; MPQ = Multidimensional Personality Questionnaire; EIV = Eysenck Impulsivity-Venturesomeness; SSS = Sensation-Seeking Scales. Different superscripts indicate significant ($p < .05$) group differences based on an independent samples *t* test.

indicates the boredom susceptibility subscale better reflects excitement seeking (Finn et al., 2000). The thrill-and-adventure-seeking subscale tends to reflect low harm avoidance, rather than excitement seeking (Finn et al., 2000, 2002) and the experience-seeking subscale reflects a preference for different types of experiences, rather than excitement seeking per se (Finn et al., 2000, 2002).

Table 1 presents the non-AD and AD group means and standard deviations for the SSAGA alcohol problem counts, weekly alcohol consumption, and personality scales, as well as the frequency of college students in each group.

Analytic procedure

As was mentioned above, three sets of variables represent the scenario outcomes of interest in the current study. First, attendance at the gatherings across the four major scenario mixtures (RHPH, RHPL, RLPH, RLPL) was operationalized as the sum of the number of scenarios attended in each mixture (ranging from 0 to 8 for each mixture). Second, drinking at the gatherings was operationalized as the sum of the number of scenarios where alcohol would be consumed for individuals reporting attendance for a given mixture (ranging from 0 to 8 for each mixture). Third, number of drinks to be consumed was operationalized as the mean number of drinks to be consumed for each of the four mixtures, where drink type and amount were standardized using alcohol equivalents provided by the Collaborative Study on the Genetics of Alcoholism, where one drink equals approximately 9 g of absolute alcohol.

Groups and individual difference analyses. Independent samples *t* tests were used to investigate the hypothesis that AD individuals would more frequently endorse attending and drinking at RHPL, RHPH, and RLPL scenarios (i.e., those scenarios with additional rewarding and/or low punishment information) than non-AD individuals. It should be

noted that differences in the degrees of freedom across the scenarios reflect the number of individuals who could viably respond to the alcohol-consumption question given their affirmative response to the attendance question. Similarly, differences in the degrees of freedom in the drink amount results reflect the number of individuals who could viably respond to the alcohol amount question given their affirmative response to the alcohol-consumption question.

In addition to the groups analyses, correlational analyses were used to examine relations among alcohol problem counts (regardless of diagnostic status), mean weekly self-reported alcohol consumption, and impulsive sensation seeking (i.e., behavioral inhibition system/behavioral activation system and related scales). Finally, regression analyses were used to examine the predictive utility of scenario outcomes in an account of actual alcohol problems.

Results

Do AD individuals attend more RHPH, RHPL, and RLPL situations than non-AD individuals?

Figure 1 displays the mean number scenarios attended (out of eight possible) per mixture of reward and punishment information for the AD and non-AD groups. Based on Reinforcement Sensitivity Theory and the meaning of alcohol dependence, it was expected that the AD group would attend significantly more high reward and/or low punishment social gatherings (i.e., RHPH, RHPL, and RLPL) than the non-AD group. Independent samples *t* tests supported the expectation for the RLPL scenarios ($t = 2.35$, 168 df, $p < .05$) but not for the RHPH scenarios ($t = 1.54$, 168 df, $p > .05$) and the RHPL scenarios ($t = 0.77$, 168 df, $p > .05$). There also was no significant difference between the AD and non-AD groups in reported attendance of the RLPH scenarios ($t = 1.98$, 168 df, $p > .05$).

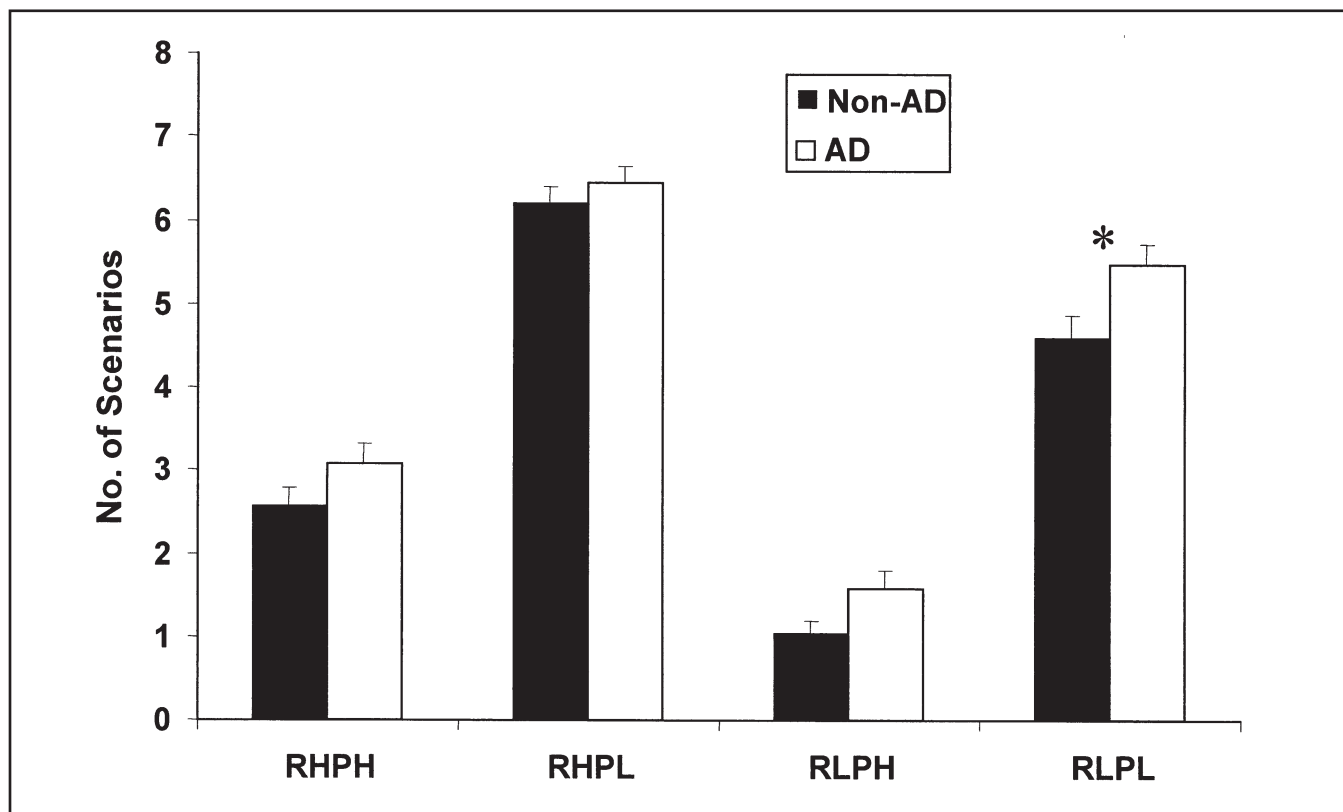


FIGURE 1. Alcohol-dependent (AD) versus non-AD group mean differences in *decisions to attend* across scenario mixtures. Bars signify mean number of scenarios attended out of eight possible per mixture. Asterisk signifies group difference based on independent samples *t* test ($p < .05$). Error bars indicate standard errors of the means. RH = reward high; PH = punishment high; RL = reward low; PL = punishment low. For all four mixtures, and n (AD) = 90 participants and n (non-AD) = 80 participants.

Do AD individuals drink at more RHPH, RHPL, and RLPL situations than non-AD individuals?

Figure 2 displays the mean number of scenarios where drinking would occur (out of eight possible) per mixture of reward and punishment information for the AD and non-AD groups. Again, it was expected that the AD group would report alcohol consumption at more high reward and/or low punishment social gatherings (i.e., RHPH, RHPL, and RLPL) than the non-AD group. Independent samples *t* tests supported the expectation for the RHPH scenarios ($t = 2.19$, 137 df, $p < .05$), the RHPL scenarios ($t = 2.15$, 167 df, $p < .05$), and the RLPL scenarios ($t = 4.19$, 158 df, $p < .05$). There was no significant difference between the groups for the RLPH scenarios ($t = 1.66$, 83 df, $p < .05$).

Do AD individuals drink more across the scenario mixtures than non-AD individuals?

Figure 3 displays the mean number of drinks consumed per scenario for the four scenarios mixtures across AD and non-AD groups. Although tautological, it was expected for purposes of construct validity that the AD group would

report greater alcohol consumption at all four scenario mixtures than the non-AD group. Independent samples *t* tests supported this expectation ($p < .05$).

How do scenario outcomes and impulsive sensation seeking predict alcohol-related problems?

Table 2 displays the correlations between the scenario outcomes and the measures of impulsive sensation seeking, alcohol problems, and alcohol consumption. As was expected, several personality scales, as well as alcohol problem counts and weekly alcohol consumption were significantly associated with scenario outcomes ($p < .05$). To examine the predictive utility of the scenario outcomes, as well as impulsive sensation seeking, a series of multiple regression analyses, followed by hierarchical regression analyses were conducted.

First, RLPH attendance, RHPL drink decision, and mean RHPL drink amount were regressed on the count of SSAGA alcohol problems. These scenario outcomes were selected for the following reasons: (1) because of their significant ($p < .05$) bivariate relations to the problem counts, (2) because they represent each of the three levels of the scenario

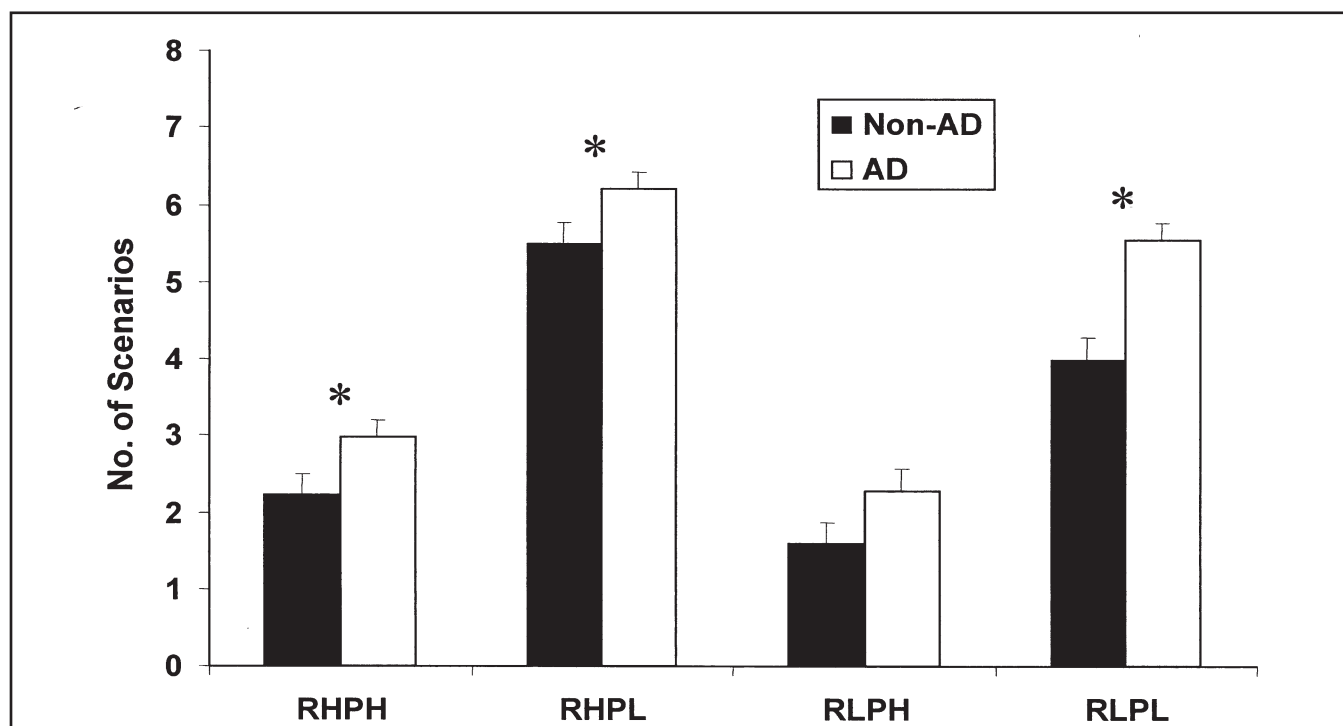


FIGURE 2. Alcohol-dependent (AD) versus non-AD group mean differences in *decisions to consume alcohol* across scenario mixtures. Bars signify mean number of scenarios where alcohol will be consumed out of eight possible per mixture. Asterisk signifies group difference based on independent samples *t* test ($p < .05$). Error bars indicate standard errors of the means. RH = Reward high, PH = Punishment high, RL = Reward low, PL = Punishment low. *n*'s (AD) = 77 (RHPH), 89 (RHPL), 50 (RLPH), and 85 (RLPL); *n*'s (non-AD) = 62 (RHPH), 80 (RHPL), 35 (RLPH), and 75 (RLPL).

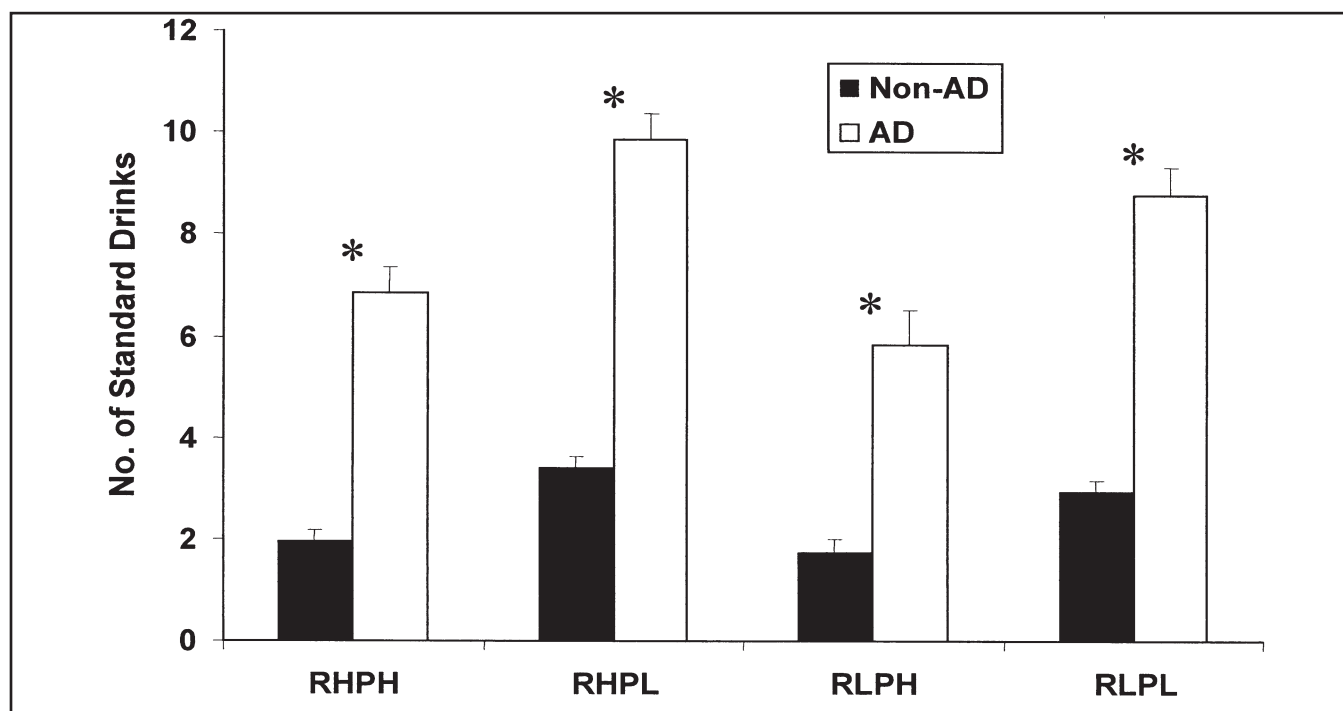


FIGURE 3. Alcohol-dependent (AD) versus non-AD group mean differences in *number of drinks to be consumed* across scenario mixtures. Bars signify mean number of drinks to be consumed in each mixture. Asterisk signifies group difference based on independent samples *t* test ($p < .05$). Error bars indicate standard errors of the means. RH = reward high; PH = punishment high; RL = reward low; PL = punishment low. *n*'s (AD) = 71 (RHPH), 88 (RHPL), 47 (RLPH), and 83 (RLPL); *n*'s (non-AD) = 55 (RHPH), 78 (RHPL), 30 (RLPH), and 71 (RLPL).

TABLE 2. Correlations among scenario outcomes and impulsive sensation seeking, and self-reported alcohol problems and consumption

Variable	Impulsive sensation seeking						SSAGA alc. probl. count	Weekly alc. consump.
	BIS	BAS reward- respon.	BAS drive	BAS fun seeking	MPQ-HA	EIV-IMP		
RHPH attend	-.06	.04	.07	.13	-.14	.15	.09	.18*
RHPL attend	-.10	.14	.09	.20*	-.10	.14	.13	.04
RLPH attend	.00	.01	.09	.11	-.05	.00	.07	.21*
RLPL attend	-.17*	.15	.14	.24*	-.11	.07	.13	.16*
RHPH drink	-.07	.02	.16	.21*	-.22*	.23*	.13	.30*
RHPL drink	-.14	.10	.10	.23*	-.17*	.17*	.16*	.17*
RLPH drink	.02	-.01	.08	.13	-.03	-.05	-.05	.29*
RLPL drink	-.16*	.15	.15	.27*	-.19*	.13	.18*	.26*
RHPH drink no.	-.33*	-.14	.25*	.37*	-.23*	.35*	.37*	.62*
RHPL drink no.	-.42*	-.11	.19*	.37*	-.35*	.32*	.33*	.68*
RLPH drink no.	-.44*	-.14	.25*	.35*	-.17	.22	.45*	.58*
RLPL drink no.	-.41*	-.15	.14	.36*	-.28*	.25*	.33*	.63*
SSAGA alc. problem count	-.12	-.01	.25*	.50*	-.36*	.44*	.37*	—
Weekly alc. consumption	-.31*	-.01	.22*	.36*	-.34*	.30*	.32*	.65*

Notes: BIS = Behavioral Inhibition Scale; BAS = Behavioral Activation Scale; respon. = responsiveness; MPQ-HA = Multidimensional Personality Questionnaire-harm avoidance scale; EIV-IMP = Eysenck Impulsivity-Venturesomeness-impulsivity scale; SSS-BS = Sensation-Seeking Scales-boredom susceptibility scale; SSAGA = Semi-Structured Assessment for the Genetics of Alcoholism; alc. = alcohol; probl. = problem; consump. = consumption; RH = reward high; PH = punishment high; RL = reward low; PL = punishment low; attend = sum of attendance responses across eight scenarios in a given mixture; drink = sum of alcohol consumption responses across eight scenarios in a given mixture; drink no. = mean number of drinks consumed across a given mixture.

* $p < .05$.

questions (i.e., attend, consume, drink amount), and (3) because responses were available for nearly the entire sample (i.e., two participants from each group indicated they would not drink at any of the RHPL scenarios, thereby precluding them providing responses to the RHPL drink questions). Second, and again, using the correlational results as a guide, behavioral-activation-system fun seeking, Multidimensional Personality Questionnaire-harm avoidance, Eysenck Impulsivity-Venturesomeness-impulsivity, and Sensation Seeking Scales-boredom susceptibility were regressed on the count of SSAGA alcohol problems. These two separate sets of multiple regression analyses resulted in significant predictions to alcohol problem counts for RLPH attendance ($\beta = .15, p < .05$), mean RHPL drink amount ($\beta = .68, p < .05$), and behavioral-activation-system fun seeking ($\beta = .29, p < .05$), Multidimensional Personality Questionnaire-harm avoidance ($\beta = -.15, p < .05$), Eysenck Impulsivity-Venturesomeness-impulsivity ($\beta = .17, p < .05$), and Sensation Seeking Scales-boredom susceptibility ($\beta = .17, p < .05$), respectively.

Finally, hierarchical regression analyses were used to examine the incremental validity associated with the select scenario outcomes. A preliminary model was examined, regressing weekly alcohol consumption, as well as the above impulsive sensation seeking and scenario outcome predictors on the count of SSAGA alcohol problems. The preliminary model resulted in nonsignificant predictions for Multidimensional Personality Questionnaire-harm avoidance

($\beta = -.03, p > .05$) and Sensation Seeking Scales-boredom susceptibility ($\beta = .04, p > .05$). The final model, excluding Multidimensional Personality Questionnaire-harm avoidance and Sensation Seeking Scales-boredom susceptibility, demonstrated the incremental validity of the scenario outcomes in the prediction of alcohol problem counts and provided a substantial account of the variance ($r^2 > 50\%$) of SSAGA alcohol problem counts (see Table 3).

Discussion

The goal of the present study was to develop and test an assessment of alcohol-consumption decision making guided by insights from Ecological Systems Theory and Reinforcement Sensitivity Theory. To that end, a series of hypothetical role-based scenarios that varied in their presentation of rewarding and punishing information were administered to a sample of AD and non-AD college-age individuals. Based on Reinforcement Sensitivity Theory, it was expected that AD individuals would be more likely than non-AD individuals to indicate attendance and alcohol consumption at the hypothetical social gatherings when the scenarios described additional rewarding and/or low punishment information (i.e., at RHPH, RHPL, RLPL scenario mixtures). Overall, the results provided some support for this contention, especially for consumption at the gatherings. Moreover, correlational and regression analyses provided evidence for the predictive utility of the scenario outcomes in an account of actual

TABLE 3. Scenario outcomes provide incremental predictive account of SSAGA alcohol-problem counts

Variable	SSAGA alcohol problem count				
	β	B (SE)	r^2	Δr^2	ΔF
Step 1					
Intercept		9.78 (1.59)			
Mean weekly alcohol consumption	.65	0.55 (0.05)	.42	—	—
Step 2					
Intercept		-13.90 (5.78)			
Weekly alcohol consumption	.54	0.46 (0.05)			
BAS fun seeking	.21	6.76 (2.18)			
EIV-impulsivity	.16	0.56 (0.23)	.52	.097	15.89
Step 3					
Intercept		-15.04 (5.44)			
Weekly alcohol consumption	.30	0.25 (0.07)			
BAS fun seeking	.17	5.40 (2.08)			
EIV-impulsivity	.15	0.49 (0.21)			
RLPH attend	.12	1.25 (0.56)			
RHPL drink no.	.33	1.23 (0.30)	.58	.061	11.29

Notes: SSAGA = Semi-Structured Assessment for the Genetics of Alcoholism; BAS = Behavioral Activation Scale; EIV = Eysenck Impulsivity-Venturesomeness; RL = reward low; PH = punishment high; RH = reward high; PL = punishment low; attend = sum of attendance responses across eight scenarios in a given mixture; drink no. = mean number of drinks consumed across a given mixture.

All standardized and unstandardized coefficients, as well as change in F , $p < .05$.

alcohol problems. A review of the findings and insights of the present research, as well as limitations and implications, are discussed in the following sections.

Importance of contextualized information in alcohol-consumption decision making

In contrast to previous research on alcohol consumption and dependence, much of which has focused (rightly so) on the importance of more general traits, abilities, and/or demographic influences, the present study endeavored to explore the situational factors that influence attendance and alcohol-consumption decisions at social gatherings. Consistent with expectations, the AD group indicated more attendance at the RLPL scenarios. However, there were no significant group differences in attendance for the RHPH, RHPL, and RLPH scenarios. Although a difference between the groups in attendance at the RLPH scenarios was not expected, the absence of a difference for the RHPH and RHPL suggests opposing influences on attendance that function similarly between the groups. First, high punishment information seems to have a similar restricting influence on attendance for both groups, such that the intensity of the accompanying rewarding information does not differentiate between the two groups in either mixture. Second, the RHPL combination seems unique in that it appears to disinhibit attendance nearly equally for both groups. In other words, it seems that the barriers to entry are so low and the enticements are sufficient enough to attenuate any difference between the two groups. Overall, the results for the attendance decisions suggest a somewhat similar pattern of influence of contextualized rewarding and punishing information.

The results for the consumption decisions were entirely consistent with the hypothesized differences between the groups, showing that the AD group was likely to drink at more RHPH, RHPL, and RLPL scenarios than the non-AD group. These findings highlight the relevance of a Reinforcement Sensitivity Theory framework to an understanding of alcohol-consumption decisions. That is, it was expected that AD individuals, already tending to be more impulsive and sensation seeking and also being more approach-oriented to alcohol information, would be more sensitive and receptive to complementary contextual information that was nominally rewarding and/or less punitive, and, as a result, endorse more consumption responses. The results supported this expectation. Although the group differences for the RHPL and RLPL scenarios are instructive, the difference between the groups for the RHPH scenarios is the most telling because it represents the type of situation that is particularly detrimental to role-related outcomes and experiences. For example, an AD student is likely to drink at more RHPH scenarios than a non-AD student and, as a result, is at greater risk of experiencing negative outcomes associated with the high punishment information included in the scenario (e.g., important exam the next day). This group difference suggests an improper weighting of highly rewarding information in the context of highly punishing information, and, more generally, fits with the patterns of poorer social and performance outcomes associated with alcohol dependence. To the extent that this sort of pattern is robust, prevention and intervention programs might be tailored to emphasize optimal management of situations that require foregoing an immediately rewarding context to avoid a near-term (and potentially long-term) deleterious role-related outcome.

The results for the amount of alcohol consumed at the gatherings are interesting for their depiction of the differences in the amount of alcohol estimated to be consumed between the two groups. Across the scenario mixtures, the AD group indicated roughly a threefold increase in the amount of alcohol to be consumed compared with the non-AD group. These results highlight the well-documented, excessive-consumption component of alcohol dependence but also suggest that situational factors still wield some influence in the amount consumed.

Predictive utility of scenario outcomes in an account of actual alcohol problems

To examine the utility of the scenarios beyond a depiction of attendance and consumption in hypothetical contexts, the scenario outcomes were correlated with measures of impulsive sensation seeking and were subjected to hierarchical regression analyses of diagnostic alcohol problem counts. As was expected, measures of impulsive sensation seeking showed patterns of relations to the scenario outcomes, which highlighted the utility of an Reinforcement Sensitivity Theory-based integration of rewarding and punishing information. Measures of behavioral inhibition were negatively associated with many of the consumption outcomes, indicating that individuals of both diagnostic groups were less likely to consume alcohol and/or consume less of it at the scenario gatherings if they were harm avoidant or generally tried to avoid punishing events. In contrast, measures of approach tendencies were positively associated with many of the attendance and consumption outcomes. In particular, the behavioral activation system fun-seeking scale showed the most robust pattern of relations, indicating that individuals who have a desire for new rewards and rewarding events are more likely to attend, drink at, and consume more alcohol at the scenario gatherings.

Hierarchical regression analyses were used to explore the extent to which scenario outcomes added a statistically significant increment to the predictive account of actual alcohol problem counts. These analyses demonstrated the importance of RLPH attendance and RHPL drink amount in an account of diagnostic alcohol problem counts, even when controlling for predictions from self-reported weekly alcohol consumption, behavioral activation system fun seeking and Eysenck Impulsivity-Venturesomeness-impulsivity. The systematic inclusion and variation of contextually rewarding and punishing information in an assessment of alcohol-consumption decision making provided a substantial account of alcohol problems. Although these analyses showed the predictive utility of the scenario outcomes, they are neither intended nor designed to depict a psychological system of influences. As such, future research would benefit from an assessment and analytic approach that can model scenario responses in the context of a coherent system of cognitive (e.g., working

memory, IQ) and motivational (e.g., multiple domains of personality, including impulsive sensation seeking, hostility, negative emotionality) influences on alcohol-related problems.

Limitations and conclusions

The primary limitation of the study is a core challenge associated with ecologically based forms of assessment. In its current form, this type of assessment is lengthy and somewhat demanding of the participant. It is clear from the reliability, group, correlational, and regression analyses that responses to all 32 scenarios, although necessary for the analytic and validation purposes of the present study, are not necessary to obtain a useful index of scenario attendance decision, consumption decision, and consumption amount outcomes. Item reduction would reduce the burden on participants and allow for the use of the scenarios as a complement to other research aims in larger projects. Moreover, the content of the assessment, although tailored to the contexts of relevant life roles, is hypothetical, resulting in unknown variability in the participants' subjective interpretations of the contingencies presented in the scenarios (e.g., the difference between knowing you have a test tomorrow and being told to imagine that you will). Other limitations include the lack of sample representativeness, as well as the degree of stability of the attendance and consumption decisions over time. These issues are important to the extent that attendance and consumption decisions vary by gender, age, ethnicity, education level, and temporal span—variables which, for reasons of statistical power, homogeneity, or design, could not be examined in the current study. In addition, future research using such an ecological approach would benefit from an experimental manipulation of blood alcohol content, a factor widely known to impair decision making.

Despite the limitations, the results of the present study suggest three important trends. First, decisions to attend the hypothetical gatherings differed only between AD and non-AD groups in the RLPL mixture, suggesting that attendance decisions are largely unaffected by alcohol-dependence status and variations in contextual reward and punishment information. Second, and in contrast to the first trend, differences between alcohol-dependence and non-alcohol-dependence consumption decisions were found in the RHPH, RHPL, and RLPL mixtures, suggesting that AD individuals are more readily influenced by complementary rewarding and/or nonpunishing information when deciding to consume alcohol. Third, regression results provided evidence for the criterion-related validity of scenario outcomes in an account of actual alcohol problems, illustrating the predictive gains associated with an assessment approach to alcohol-consumption decision making that combines situational information organized and balanced through the frameworks of Ecological Systems Theory and Reinforcement Sensitivity Theory.

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